Fortunately one case has been studied which is not thus complicated, *i. e.*, the arc in mercury vapor between mercury terminals. In this case only one element is to be considered, and here Arons * found that the greater fall of potential was at the anode. In the light of the work now described we may interpret this to mean that the positive ions in such an arc move the more rapidly.

Warburg † found that in case of discharge in a vacuum tube containing some mercury vapor the fall of potential at the cathode was approximately the same as it was in nitrogen. Arons in discussing this calls attention to the fact that when discharge is taking place through a gas the greater fall of potential is at the cathode, when through a metal vapor at the anode. Possibly we may now modify this statement and say that when *gases are ionized the negative ions move the more rapidly, but that when metal vapors are ionized the positive ions move the more rapidly.* All the facts that have thus far been observed could be explained by such a hypothesis. If this should be shown to be correct, it will no doubt lead us to modify somewhat our ideas concerning the relation of metals to electricity.

C. D. CHILD.

MODULUS OF CONSTANT CROSS SECTION.

THE longitudinal rigidity of a solid, represented by Young's modulus, depending as it does upon both the volume elasticity and simple rigidity, leaves one condition unprovided for *viz.:* the case of longitudinal extension with cross section remaining unchanged. This case probably does not occur with an unrestricted stress, but it is easily conceived in theory. I can find no mention anywhere of a modulus of constant cross section, and have undertaken to approach the problem in this wise. Add to Young's modulus that fraction of the simple rigidity represented by Poisson's ratio. This preserves the longitudinal rigidity and restores to the new modulus the numerical measure of that portion of the strain called out by the change in lateral dimensions.

If this be a true modulus, it offers an easy method of determining approximately the mechanical equivalent of heat, and provides a practical experiment for laboratories not supplied with costly and complete apparatus. Thus a brass wire of density 8.5; sp. heat, of .09, coefficient of expansion .000018, volume elasticity 10×10^{11}, simple rigidity 3.7×10^{11}, and Young's modulus 10.4×10^{11} gives roughly,

$$\frac{\left[10.4 \times 10^{11} + \left(\frac{22.6}{67.4} \times 3.7 \times 10^{11}\right)\right]\frac{1}{2} \times .000018}{\frac{8.5 \times .09}{3}} = 4.1 + \times 10^{7}$$

as the value of the calorie in C. G. S. units.

BENJ. H. BROWN.

NOTES ON INORGANIC CHEMISTRY.

WITHIN the past few years much has been added to our knowledge of the chemistry of the alums. To the aluminum, chromium, iron, gallium, and indium alums have been added those of titanium, vanadium, manganese, and cobalt. This completed the series of alums of the metals of the period from titanium to cobalt, but beyond this no alums were known of metals outside of the third group. In the last number of the *Zeitschrift für anorganische Chemie* Professor Piccini of Florence, the discoverer of the titanium and vanadium alums, has described a series of rhodium alums, including those of potassium, ammonium, rubidium, cesium and thallium. This is of peculiar interest, since rhodium belongs to a period in which no alums have been known, and opens the question as to whether there may be other alums in the same period, which includes molybdenum and columbium. Piccini is at present endeavoring to form iridium alums, which the preparation of the rhodium alums makes seem possible.

IN a paper in the last *Berichte* of the German Chemical Society, on radio-active lead, Professor K. A. Hofmann of Munich and Eduard Strauss describe two new substances which appear to be new chemical elements. Both are found in the lead chlorid obtained from pitchblende, and are separated from the lead by fractional crystallization. The one substance possesses no radio-activity and resembles some-

* *Wied. Ann.*, 58, 78.

† *Wied. Ann.*, 40, 10.

what ruthenium. Its combining weight is 50.46, and hence if bivalent it would have an atomic weight of 100.92. In this case it would be the missing eka-manganese, but the authors put this forward merely as a suggestion, pending a more thorough investigation. That which would tell most strongly against this supposition is the fact that the new substance forms a white sulfate which is insoluble in water and in dilute sulfuric acid, and stable up to a temperature of 400° to 500°. The second new substance described by Hofmann and Strauss is found in the lead chlorid, both from pitchblende and from bröggerite. This substance is radio-active, though the authors express doubt as to whether the activity of the lead from these minerals is due solely to the presence of this new substance. It appears to have a combining weight of 86, from which an atomic weight of 172 would follow, provided the metal is, as would seem probable from its resemblance to lead, bivalent. It might then be a metal of the fourth group, between tin and lead, and the representative of the period, none of whose members are definitely known. Of the compounds of this element, if such it be, the sulfate alone shows radio-activity. After the action of the kathode rays the substance shows a fluorescence, which lasts for upwards of two minutes.

The same number of the *Berichte* contains the description by Professor Hoffman and W. Prantl of a new element in the euxenite from Brevig. This euxenite, which is a complex silicate, titanate and columbate of the rare earths, iron, and aluminum, contains about two per cent. of what is supposedly zirconia. Hofmann finds that half of this is a new oxid, differing from zirconia, by its insolubility in ammonium carbonate, its giving no color reaction with curcuma, and having a combining weight of 44.4, which is nearly double that of zirconium. The atomic weight of the new element, if quadrivalent like zirconium, would be about 178. The same mineral seems also to contain another hitherto unknown element, which bears some resemblance to tantalum, but which has not yet been carefully examined.

In spite of the incredulity with which his claims to convert phosphorus into arsenic and antimony have been received by chemists, Fittica still continues his work upon the subject. In his latest experiments he heats amorphous phosphorus with lead oxid and boron. At 140° water is formed and after heating to 205° the residual mass is found to contain lead sulfate and the borid of nitrogen. If boric acid anhydrid is used in the place of the litharge, water, sulfuric acid and the borid of nitrogen are likewise formed, but also arsenic and sometimes antimony. From these experiments Fittica concludes that amorphous phosphorus is a compound of nitrogen, sulfur and hydrogen, and he assigns to it the formula N_2SH_2. He does not, however, furnish satisfactory proof that this represents the actual quantitative composition of phosphorus. He also admits that when amorphous phosphorus is oxidized with nitric acid no trace of sulfuric acid is formed.

J. L. H.

BOTANICAL NOTES.

INTERNATIONAL BOTANICAL ASSOCIATION.

A call, signed by sixteen botanists of Europe and America, has been issued for a meeting of the botanists of the world at Geneva, Switzerland, on the 7th of August next, for the purpose of organizing an International Botanical Association. In the call it is stated that the chief object of the Association will be the foundation of a bibliographic periodical, criticizing in a perfectly impartial manner all botanical publications in such a way that the more important shall be separated from those which are of less value. Other advantages to be derived from the proposed organization are presented, and correspondence with the secretary, Dr. I. P. Lotsy, of Wageningen, Holland, is solicited.

STOCK-POISONING PLANTS.

The Division of Botany of the United States Department of Agriculture has recently issued a valuable bulletin (No. 26) dealing with the plants which are known to be poisonous, or which are thought to be poisonous to stock in the State of Montana. About twenty-five pages are given to a general discussion of the conditions under which poisoning occurs, and of remedies and their application. Then follow about sixty pages devoted to a few plants of the